August 3, 2018

Via ECFS
Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: Wireless E-9-1-1 Location Accuracy Requirements
PS Docket No. 07-114

Dear Ms. Dortch:

In accordance with Section 20.18 of the rules of the Federal Communications Commission, Sprint hereby files the attached progress report in the above-referenced docket.[1]

Please contact the undersigned if there are questions concerning this filing.

Sincerely,

/s/ Ray Rothermel

Ray Rothermel
Counsel-Legal/Government Affairs
Sprint Corporation
900 7th Street, NW, Suite 700
Washington, DC 20001

Attachment

[1] *See* 47 C.F.R. § 20.18.

August 3, 2018 - Wireless E9-1-1 Location Accuracy Progress Report

Sprint continues to make significant progress in collaboration with the wireless industry and participants from the public safety community in fully realizing the goals and requirements set forth by the Federal Communications Commission ("FCC" or "Commission") to improve indoor location accuracy for wireless 9-1-1 callers. This progress report is consistent with and represents an update to the Sprint Wireless E9-1-1 Location Accuracy Implementation and Initial Progress Report filed with the Commission on February 3, 2017 in PS Docket No. 07-114.

In summary, Sprint's sizeable and multi-faceted contributions have helped establish the National Emergency Address Database ("NEAD"), which is fully organized to address the needs of public safety and to help ensure wireless carriers are able to leverage the database to provide a Dispatchable Location for first responders during wireless 9-1-1 calls. In November 2017, the FCC approved a key component - the NEAD Privacy & Security Plan – prepared and submitted by Sprint and the other major nationwide wireless carriers after a significant amount of work, collaboration and consultation with industry partners, privacy and security legal and policy experts and concerned members of the public safety community. In June 2018, the National Emergency Address Manager ("NEAM") began accepting and processing production grade reference points having a verified Dispatchable Location.

The National Emergency Address Database LLC ("NEAD LLC") established a website – www.911nead.org - to help inform and educate the public and interested parties about the NEAD and how it can be utilized to continue further enhancements to wireless 9-1-1 location accuracy. The NEAD LLC also began to interact with a variety of reference point owners to help the wireless industry achieve the Commission's requirement to database a specific percentage of reference points in future years. While not limited to any one particular model or description, reference point owners could include Internet service providers that typically distribute large numbers of Wi-Fi routers, businesses that own and operate numerous Wi-Fi routers or networks to serve

their employees and/or customers and any other type of service or provider that leverages Wi-Fi or Bluetooth technology. The NEAD is now considered operational for testing, which will be conducted later this year. In coordination and collaboration with the major public safety organizations, including the Association of Public-Safety Communications Officials-International ("APCO"), the National Emergency Number Association ("NENA") and the National Association of State 911 Administrators ("NASNA"), Sprint and the other major nationwide wireless carriers have identified considerations for the full eventual implementation of Dispatchable Location information all the way through to the call taker in a Public Safety Answering Point ("PSAP") and plan for an evaluation of end-to-end implementation by the end of the year.

By way of background, the FCC requires nationwide wireless carriers to generate either a Dispatchable Location ("DL") or X/Y location information within 50 meters for a certain percentage of wireless calls to 9-1-1 within specific timeframes. Dispatchable Location solutions provide the verified street address, plus additional location information from the NEAD that will help locate, with increased accuracy, a wireless subscriber placing a call to 9-1-1. By investing in Dispatchable Location solutions, Sprint is leveraging existing and evolving wireless technologies, such as Wi-Fi and Bluetooth, to help improve the ability of first responders to locate wireless 9-1-1 callers that may be indoors.

Several years ago, Sprint and the other nationwide wireless carriers committed to provide substantial, ongoing funding and support to implement the NEAD. The NEAD LLC was formed as an independent company to administer and operate the NEAD consistent with the FCC's rules. The NEAD LLC then selected the Alliance for Telecommunications Industry Solutions ("ATIS") as the program manager for the NEAD. The NEAD LLC has implemented the NEAD platform in strict accordance with the FCC rules, including relevant technical standards and privacy and security requirements. The NEAD LLC, based on input from the NEAD LLC Technical Advisory Committee

("TAC"), filed the separate privacy and security plan for the NEAD with the FCC, which was approved by the Commission in November 2017 in accordance with its rules.

The NEAD LLC is supported by ATIS, as the program manager, its vendors, a Technical Advisory Committee and a Steering Committee. Both committees are comprised of key public safety and wireless industry participants. The structure of the NEAD LLC is modeled after the FCC Communications, Security, Reliability & Interoperability Council ("CSRIC") IV recommended structure for the 9-1-1 Location Technologies Test Bed ("Test Bed"). As the NEAD program manager, ATIS oversees and supports implementation of the NEAD platform by the technology vendor. Sprint, along with the other nationwide wireless carriers and public safety representatives participating in the NEAD working group and TAC, was instrumental in drafting specifications for the NEAD and ultimate vendor selection to develop and operate the NEAD. ATIS also provides support and coordination for NEAD project management, technical specifications and standards development, database operations and outreach to access point owners and administrators. The NEAD technical specifications and overall design are based on the standards independently developed by the ATIS Emergency Location ("ELOC") Task Force and working through the American National Standards Institute ("ANSI") accredited standards setting process.

The NEAD LLC receives advice and guidance from a Technical Advisory Committee ("TAC") and Steering Committee, both of which include members representing the wireless carriers and public safety associations. Through the NEAD LLC, the national wireless providers provide substantial funding to fully support the NEAD LLC's operations and administration, ATIS program management, as well as initial design, development and ongoing operation of the NEAD platform. With input from the NEAD LLC's Steering Committee, various cost-sharing models are being

considered to help ensure that ongoing NEAD costs are allocated equitably among providers who support or utilize the NEAD for Dispatchable Location solutions.

Through a collaborative process with members of the public safety community and the wireless industry, ATIS ELOC helped develop standards upon which the NEAD design and technical specifications are based. Sprint is part of the membership of ATIS ELOC and contributed to the ATIS standards with which implementation of the NEAD is consistent.

Wireless carriers test Dispatchable Location solutions in the 9-1-1 Location Technologies Test Bed to verify that NEAD information can be utilized to provide a Dispatchable Location consistent with the FCC regulations and technical parameters adopted by the ATIS ELOC. The ATIS Emergency Services Interconnection Forum ("ESIF") Emergency Services & Methodologies ("ESM") has a methodology to run Dispatchable Location solutions through the Test Bed. The NEAD, along with requisite support by the wireless networks, must be operational for testing of Dispatchable Location solutions to occur. Prior to wireless carriers utilizing the NEAD and Dispatchable Location solutions, they must certify that the information will only be used for 9-1-1 emergency purposes.

The prospect of Dispatchable Location being provided to public safety during a wireless 9-1-1 call is dependent on the number of wireless access points within the NEAD. Dispatchable Location solutions will eventually grow into ever-increasing stages of accuracy as different location solutions become more widely available and Wi-Fi and Bluetooth wireless access points are continually entered into the NEAD. The FCC rules require that the NEAD contain a certain minimum number of wireless access points in the top 50 Cellular Market Areas by 2023 equal to 25% of the particular CMA population. The national wireless carriers are submitting information about Wi-Fi and Bluetooth wireless access points they control and manage to the NEAD initially. The NEAD LLC and ATIS NEAD Outreach Manager encourage wireless access point owners and

administrators, such as broadband service providers, large enterprises and public institutions, to contribute such data to the NEAD in the interest of public safety. Stakeholders from key industries, public safety and enterprises all need to be involved for the NEAD and Dispatchable Location solutions to be effective.

Sprint remains fully committed to working with the other nationwide wireless carriers and other wireless industry 9-1-1 stakeholders to continue to improve indoor wireless 9-1-1 location accuracy. As part of that effort, and as required under Commission rules, Sprint partnered with CTIA to submit a Z-axis (vertical elevation) accuracy metric recommendation to the FCC, which is based on an independent test bed report. The group relied on the ATIS *Guidelines for Testing Barometric Pressure-Based Z-Axis Solutions* (ATIS-0500030). The process leading up to the recommendation included the independently administered test bed to assess vertical location solutions and provide actual, real-world test results. While other technological solutions may continue to evolve over time, only two vendors participated in the testing of their current vertical location solutions. Sprint and the other carriers, along with CTIA, have spent a substantial amount of financial investment and other resources in the efforts to improve indoor 9-1-1 location accuracy.

The two location technology solution vendors that participated in Z-axis testing used entirely different approaches: one with a licensed wireless network of metropolitan beacons that broadcast information to a mobile device calling 9-1-1; and, the other a software-based solution that collects data from a mobile device calling 9-1-1 to then apply proprietary algorithms in generating a vertical location estimate. Testing occurred in dense urban, urban, suburban, and rural morphologies of the Atlanta, San Francisco, and Chicago regions and was conducted in forty-eight various types of buildings, using over three hundred test points with thirty mobile devices, including twelve different models, producing more than one hundred thousand location

estimates. While testing in all regions and morphologies is the only way to verify performance in the real world, only one vendor participated in testing for all regions and morphologies.

While the testing provided supporting data, it also raised serious concerns about performance of the solutions in live environments and whether the technologies are mature and scalable enough to duplicate results in the real world. For example, Chicago was recommended as a test region due to the propensity for extreme weather there, which could impact technologies that can be sensitive to temperature differentials as well as great fluctuations in barometric pressure. While only one vendor tested in the Chicago region, the weather present at the time was not considered the typical weather for that time of year. In addition, testing was not conducted with both vendors in rural environments, nor was it conducted across all mobile device operating systems.

The results of the testing also showed that sensor bias can be a primary source for error when attempting to estimate Z-axis and that an individual mobile device may be subject to unique sensor bias requiring calibration on a per-device basis, which could prove to be a difficult proposition in wide scale commercial deployment. There is also potential concern over the accuracy of barometric sensors as they age, according to manufacturers. Further testing is required in live, real-world calling environments to confirm the issues that remain from a technological perspective. It is clear that additional development, standardization and full scale implementation into wireless networks and devices would be necessary to conduct rigorous and complete testing. As required under the Commission's rules, Sprint and the other national wireless carriers have submitted a report on the development and testing of Z-axis solutions to support the recommendation to the FCC for a Z-axis metric consistent with +/- 5 meters for 80% of fixes from mobile devices capable of delivering barometric pressure sensor-based altitude estimates.

Sprint and the other carriers, along with CTIA, found that the testing helped provide valuable insight into existing Z-axis technologies and also raised real-world performance questions and concerns. Other potential technological solutions may soon be available for testing that may utilize a different approach entirely. While it remains to be seen and tested, such future solutions may help address some concerns related to use of barometric pressure sensors. Sprint supports the need for additional Z-axis testing before the Commission moves to adopt a Z-axis metric.

Sprint continues to be very active in a significant number of industry standards activities as well as coordinating activities in support of the nationwide wireless carrier 9-1-1 indoor location accuracy obligations. This ongoing effort helps ensure consistency in network operational performance across carriers for the benefit of public safety by having a common set of specifications and interfaces that vendors can use in development and support of the wireless carriers. It also helps reduce the number of varieties of interfaces which each carrier and PSAP needs to support for wireless networks to interface with Next Generation 9-1-1 selective routers, as well as the NEAD. Industry standards also increase consistency of performance, customer experience and first responder experience in locating a 9-1-1 caller.

Expert and committed internal representatives continued to participate in key standards activities on behalf of Sprint to support the development of the elements of 9-1-1 indoor location accuracy improvement capabilities standards. Our teams maintain a high degree of subject matter expertise on 9-1-1 technologies and solutions, managing the highly technical engineering aspects of wireless network integration and deployment, selecting and managing vendors, developing regulatory reporting systems and processes and developing and implementing new technologies for the benefit of public safety.

August 3, 2018 - Wireless E9-1-1 Location Accuracy Progress Report

Sprint actively participates in the working groups that oversee all the work involved in meeting the FCC indoor location accuracy requirements. The groups address the various issues, including Test Bed, the NEAD, Z-Axis, Standards, PSAP Implementation, DL Demonstration and NEAD Outreach. They include participation the other nationwide wireless carriers, as well as public safety representatives and wireless industry companies and organizations. Sprint co-chairs the Standards working group with the important task of coordinating standardization of all the many elements in different standards groups within ATIS and 3GPP associated with the highly technical implementation of wireless 9-1-1 indoor location accuracy improvements. The PSAP Implementation working group, also co-chaired by Sprint, is responsible for the guidelines and processes to assist PSAPs in implementing location solutions that will include presentation of location data, such as Dispatchable Location and barometric pressure data for 9-1-1 calls. Sprint is also an active participant in the CTIA 9-1-1 Location Accuracy Advisory Group established to help coordinate the common industry efforts supporting 9-1-1 location accuracy improvements.

Overall, Sprint, along with the entire wireless industry is making meaningful progress toward improving indoor location accuracy for 9-1-1 callers. By leveraging commercial technologies, public safety officials can rely on better information to help save lives and prevent further damage in emergency situations. With continuing innovation and investment, legacy 9-1-1 systems are being replaced with newer and technologically superior equipment on the public safety answering side. Coupled with remarkable and ongoing advancements across the wireless telecommunication industry, the goal of improving 9-1-1 location accuracy, no matter where the caller may be, is steadily being realized. With the investigation and testing of new and different solutions, such as device-based hybrid (“DBH”) location technology solutions, public safety will soon be able to leverage and take full advantage of all available technologies being used to locate wireless callers. DBH solutions use a combination of technologies and available sensors to

supplement information already available in wireless networks and devices. DBH has the potential to be available across the country where wireless carriers offer coverage, including many of the communities where the vast majority of Americans live and work. DBH will be available with modern wireless devices from multiple manufacturers and chipset providers. Another great advantage to DBH technologies is that PSAPs would not have to install new equipment or software and would therefore be able to avoid any additional expenditures to take advantage of this solution. In testing, DBH has produced accurate and reliable location information in different types of buildings and in various morphologies.

Sprint continually and routinely collaborates with wireless device OEMs and operating system providers to improve existing location technology performance in support of wireless Phase II Enhanced 9-1-1, as well as for the development of new technologies and solutions such as the NEAD. With standardized solutions, such as the variety of location capabilities supported by Long Term Evolution ("LTE") positioning protocols and the associated extensions supporting Wi-Fi and Bluetooth crowd sourcing, Sprint expects to take full advantage of available technologies when Voice over LTE ("VoLTE") service becomes commercially available on the Sprint nationwide wireless network. We are primarily an all IP-based network capable of supporting VoLTE and planned 5G networks. We fully anticipate commercial deployment of VoLTE and continue to offer High Definition Voice over our very efficient code division multiple access ("CDMA") network.

In conclusion, Sprint continues to make real and steady progress in realizing the Commission's goal to improve indoor 9-1-1 location accuracy. In working cooperatively with counterparts in the wireless industry and public safety, Sprint has demonstrated time and time again its full commitment, financial and otherwise, to the spirit and intent of the FCC regulation in this area. As wireless networks and mobile devices continue to evolve and become more

capable and efficient, we are confident our ongoing investment in emerging technologies and integration of new platforms and solutions will help ensure compliance with the metrics and milestones established by the Commission to help improve wireless indoor 9-1-1 location accuracy.